2045

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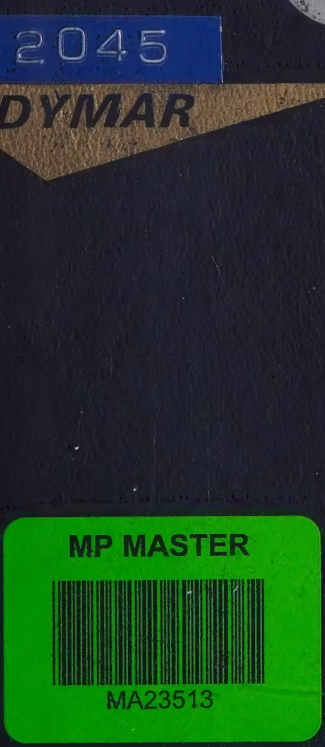

DYMAR ELECTRONICS LIMITED

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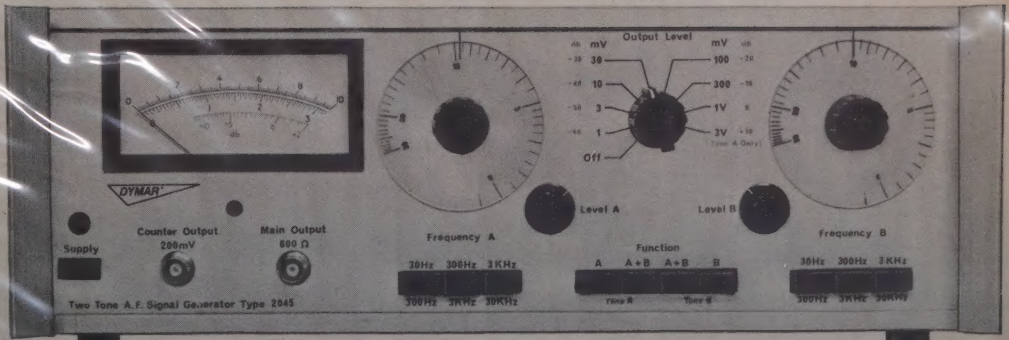


Two-Tone A.F. Signal Generator
Type 2045

1. GENERAL DESCRIPTION

The Dymar Two-Tone A.F. Signal Generator Type 2045 is designed to provide simultaneously two independent signals for intermodulation testing of a.f. amplifiers, F.D.M. links and S.S.B. circuits. It is operated from a.c. mains or from its own optional rechargeable battery and, as such, it is equally suitable as a laboratory instrument or as a portable service instrument for field testing.

The instrument consists of two identical high stability and low distortion Wien Bridge oscillators with amplitude stabilisation by means of a thermistor. Frequency and output of each oscillator can be varied independently.

The frequency range of each oscillator is 30 Hz to 30 kHz and the maximum output level is 1 volt r.m.s. for two simultaneous tones. This can be attenuated by up to 60dB in 10dB steps by means of a 600Ω precision attenuator. A fine amplitude control permits setting between steps so that the output voltage can be set precisely to the required level. For single tone only, an additional range 0 – 3 volts r.m.s. is available. The open circuit output voltage is monitored accurately on the integral meter which is calibrated to read r.m.s. values. An ancillary dB scale of -10 to +2 allows direct reading in decibels relative to 1mW.

The auxiliary socket provides a constant output from each oscillator (irrespective of attenuator or level setting) for accurate adjustment and monitoring of the frequency by means of a frequency counter.

2. SPECIFICATION

Each Oscillator

Frequency Range	30Hz to 30 kHz in three ranges: 30 Hz – 300 Hz 300 Hz – 3 kHz 3 kHz – 30 kHz
Frequency Calibration	3% ± 3 Hz
Frequency Stability	After one hour warm-up period the frequency stability over a 10 minute period at constant temperature is better than 0.01%.
Output Level	Adjustable 0 – 1mV up to 0 – 1V e.m.f. in seven steps of 10dB for two simultaneous tones. For single tone only, an additional range 0 – 3V is available.
Level Setting Accuracy	Better than 3% on integral level meter
Harmonic Distortion	Less than 0.1% from 100 Hz to 30 kHz Less than 0.3% from 30 Hz to 100 Hz.
Hum and Noise	Less than 0.05%. No hum when battery operated.

Overall Specification

Attenuator Output Impedance	600Ω ± 2% unbalanced.
Inherent Intermodulation	Better than 70dB
Counter Output	Constant level output of 200mV from an output impedance of 100Ω.
Meter	Precision 8 cm movement, calibrated 0 - 3 and 0 - 10 and a dB scale of -10 to +2dB for relative measurements.
External Power Supply	190 - 260V a.c. or 95 - 130V a.c. 50 - 60 Hz.
Internal Battery Option	25V (nominal) nickel cadmium rechargeable battery of 225 mAh capacity, giving a typical operating time of 2½ hours between recharging. Batteries are normally on permanent trickle charge, or can be re-charged in 14 hours from a fully discharged condition (23V) using the charging circuit which is integral with the battery option. The "supply ON" LED acts as a state of battery charge indicator.

Dimensions and Weight	Width Height Depth Weight* 36.8cm 12 cm 24.2cm 4.5kg 14.5in. 4.75in 9.5in. 9.9lb * with battery option
Accessories	Rack Mounting Adaptor Kit Type 1901 Simulated leather protective carrying case Type 1902.

Typical figures based on normal operating conditions.

Dymar policy is one of continuous improvement, therefore the right is reserved to change specifications without notice.

3. OPERATION

3.1 Power Supply

The instrument as despatched from the factory is normally set for 230V operation and no further tap changes or adjustments are necessary, provided the mains voltage is between 190V and 260V a.c. If the mains voltage is in the range 95V to 130V a.c., then the primary windings on the transformer have to be connected in parallel and not in series. In order to do this, remove the top and bottom covers from the Instrument and make the following adjustments on the terminal block (i.e. voltage selector), which is situated on the back panel. Remove the link which connects pins 2 and 3 and substitute it with two links between pins 1 and 3 and pins 2 and 4. Also replace the 150mA fuse with an equivalent type, but rated for 300mA.

To operate the instrument from the mains supply, push the button on the front panel marked SUPPLY and LED pilot lamp will then light up indicating that the L.T. is ON. When the Instrument is fitted with internal battery, to operate it from mains supply, slide the switch on the back panel marked MAINS – BATTERY to MAINS and push the button marked SUPPLY. The pilot lamp will then light up.

To operate the instrument from its own internal battery, slide the switch on the back panel to BATTERY, and push the button marked SUPPLY. The pilot lamp will then light up if the battery is in charged condition. If the battery is discharged, the pilot lamp will not light up and the battery

must be recharged. This is done by connecting the Instrument to the mains supply (as described above) and sliding the switch on the back panel marked CHARGE FAST – TRICKLE to CHARGE FAST.

A discharged battery, i.e. 23V can be fully re-charged in 14 hours. When the battery is charged, slide the switch to TRICKLE, and the battery is now on permanent trickle charge.

3.2 Measurement

Switch on the supply. The following front panel controls separate for each oscillator A and B are available to the user:

Three frequency range, push button switches,
Main, frequency setting dial,
Output level control.

The following front panel controls are common to both signals:

Nine position rotary output level attenuator switch.
Four function push button switches.

Frequency setting-up Procedure: Push the appropriate frequency range switch and rotate the dial to the required frequency. The four function push button switches marked A A + B Tone A A + B B Tone B connect Tone A, Tones A + B, or Tone B

to the output socket. When Tone A or Tone B is selected the meter indicates the e.m.f. of each tone respectively. When Tone $\frac{A + B}{\text{Tone A}}$ is selected the meter indicates the e.m.f. of Tone A and when Tone $\frac{A + B}{\text{Tone B}}$ is selected the meter indicates the e.m.f. of Tone B. Similarly, if either Tone A or $\frac{\text{Tone A} + B}{\text{Tone A}}$ is selected the Frequency Counter connected to "Counter Output" socket SK3 monitors Tone A frequency and if either Tone B or $\frac{\text{Tone A} + B}{\text{Tone B}}$ is selected the Frequency Counter monitors Tone B frequency.

Output level setting-up procedure: Rotate the output level attenuator switch to the required range and adjust the output level control to the required open circuit level indicated by the integral meter. The internal output impedance of the "main output" socket is 600Ω and therefore connection of an external load of 600Ω will make the voltage across the output socket (and load) to be exactly half of the indicated level on the meter. For any other load resistance "R" the relationship between the open circuit voltage e.m.f. and the actual voltage V across the load is given by the formula

$$V = \text{e.m.f.} \times \frac{R}{R + 600}$$

In the fully clockwise position of the attenuator switch, output level of up to 3V e.m.f. Tone A only can be obtained.

In the "OFF" position the output socket is terminated in a 600Ω impedance.

4. TECHNICAL DESCRIPTION

The two oscillators providing signals A and B are identical and therefore only oscillator "A" will be described.

The Generator consists basically of a "Wien Bridge" Oscillator and maintaining amplifier VT202, VT204 and VT207 (see Drawing No. A2-104454). Positive feedback is applied to the base of VT202 via the "Wien Bridge" network and this induces oscillations at the "resonant frequency" of the network. At the same time, negative feedback is applied to the emitter of VT202 through thermistor TH202, to stabilise the output amplitude. The "Wien Bridge" network which determines the frequency of oscillations is switched in three steps by S204A – B – S206A – B, which brings in different capacitance values for different ranges, and is continuously tuned across each range by the ganged potentiometers RV1A - B. For monitoring purposes constant output is taken from the emitter of VT208.

The Oscillator output is taken from the emitter of VT207 to the output "Level" control RV2 and then applied to the output stage VT213 and VT214. This consists of a "super" emitter follower with negative feedback from the collector of VT213 to the base of VT214. This results in an output impedance of only a few ohms at the emitter terminal of VT213, which in conjunction with R201, R202 and R203 gives the output impedance of the Generator. In the 3V position of the rotary output level attenuator switch (Tone

A only), the output from the emitter of VT213 is taken via R251 which determines the impedance of the Generator and in the "OFF" position the "Main Output" socket SK2 is terminated by R10.

The output voltage appearing at the low impedance point of the emitter follower VT213 is applied via the four function push button switch not only to R201, R202 and R203, but also via R230 to the two stage d.c. coupled amplifier VT209 and VT210, where it is further amplified before it is fed to the rectifying diodes D203 and D204. The resultant d.c. voltage is used to drive the meter.

The signal appearing at the junction of R201, R202, and R203 is fed to the output attenuator which consists of one 10dB pi-pad R1 - R3, one 20dB pi-pad R4 - R6 and one 30dB pi-pad R7 - R9, all of 600Ω impedance (see Drawing No. A3-104710). The switching of S1A - D is so arranged as to get values of attenuation from 0 - 60dB in 10dB steps.

The design of the power supply is conventional and consists of transformer T1 and rectifying bridge D101 giving "raw" d.c. across capacitor C101. This voltage is applied to the regulator which produces a stable voltage of approximately 25V across pins 4 and 9. Zener Diode D102 provides reference voltage for the series transistor VT101 of the regulator (see Drawing No. A2-105032).

The internal battery is recharged via polarising diode D1001 and resistor R1001 or resistor R1002.

When the equipment is supplied from mains, the pilot lamp D1 connected between pins 6 and 7 and via resistor R103 to common is used as the D.C. SUPPLY ON-OFF indicator.

When the equipment is energised from its internal rechargeable battery, the pilot lamp D1 is used not only as the D.C. SUPPLY ON-OFF indicator, but also as the battery state-of-charge indicator. This is achieved by connecting the pilot lamp D1 via resistor R103 to the collector of VT1001 transistor. Zener Diode D1002, resistor R1003 and trimming potentiometer RV1001 provide stable bias for the base of VT1001 transistor.

Potentiometer RV1001 is adjusted so that when the battery is discharged to 23V, i.e. 1.1V/cell, transistor VT1001 stops conducting, thus switching the pilot lamp D1 off.

5. ALIGNMENT PROCEDURE

5.1 If re-alignment of the instrument is required, re remove the top and bottom covers. All test points and preset controls are now accessible for adjustment. Do not adjust or tamper with these controls unless adequate test gear is available for the proper calibration of the Instrument.

5.2 The following test gear is required:

i) Oscilloscope.

ii) Wide Band Voltmeter with 1% measuring accuracy.

iii) Frequency Counter.

iv) Distortion Factor Meter.

v) Resistance Bridge with 1% measuring accuracy.

vi) D.C. Power Supply Unit 0-30V, 0.1A.

5.3 Checking of the Attenuator Impedance

Switch 'ON' the supply and rotate the output level attenuator switch to the 'OFF' position, and turn "LEVEL" control fully anticlockwise. Connect the resistance bridge to the "Main Output" socket SK2 and check that the impedance is within the specified limits at any setting of the "Output Level" attenuator switch S1A - D.

5.4 Frequency Calibration

Connect the Frequency Counter to the "Counter Output" socket SK3. Push the frequency range switch S205A - B (i.e. 300 Hz - 3 kHz) and

the function switch S207 (tone A). Set pre-set potentiometer RV204 to mid-position. Rotate the Frequency Control RV1A - B to obtain 1000 Hz reading on the Counter and adjust (mechanically) the frequency dial to indicate 10. Check that any other frequency setting indicated by the dial is within the specified limits on all three ranges. To obtain more accurate calibration at the highest frequency RV204 may be adjusted.

To check Tone B calibration push the frequency range switch S202A - B (i.e. 300 Hz - 3kHz) and the function switch S210 (tone B) and repeat procedure as described above, but rotating and, if necessary, adjusting RV4A-B dial to obtain 1000 Hz.

NOTE: On some models RV204 and RV205 are replaced by fixed "A.O.T. Resistors".

5.5 Main Output Level Adjustment

With the Instrument in its tone "A" mode 1000 Hz, connect the Wide Band Voltmeter to the "Main Output" socket SK2. Rotate the "Output Level" attenuator switch S1A-D to 1V range and the "Level" control RV2 fully clockwise. Set preset potentiometer RV203 to mid-position and adjust RV202 to obtain a reading of 1.1V r.m.s. on the Wide Band Voltmeter. Turn the "Level" control slowly anti-clockwise to reduce the reading on the Wide Band Voltmeter to 1V r.m.s. and adjust RV203 so that the integral meter reads the same voltage, i.e. f.s.d. on the 10 scale. Check that the level indicated at any other setting of the "Output Level" attenuator

switch and "Level" control is within the specified limits over the whole frequency range of the Instrument.

Switch to tone "B" mode and repeat procedure as described above, but adjusting RV201.

5.6 Checking of the Harmonic Distortion

With the Instrument in its tone "A" mode, connect the Distortion Factor Meter to the "Main Output" socket SK2 and check that the distortion is within the specified limits over the whole frequency range of the Instrument at maximum or any other setting of the output level.

Switch to tone "B" mode and repeat procedure as described above.

5.7 Checking of the Setting of RV1001 (Battery Supply)

Remove wire from pin 7 and connect d.c. supply to pins 6 and 7 (+ve to pin 7 and -ve to pin 6), set accurately to 23V. Slide BATTERY-MAINS switch S1002 to BATTERY and adjust RV1001 so that the transistor VT 1001 just stops conducting, thus switching off the pilot lamp D1. Check that when the P.S.U. voltage is slightly increased D1 lights up.

6. COMPONENTS LIST

NOTE: All resistors are in Ω and all capacitors are in μF, unless otherwise stated.

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
6.1	**Resistors**			
R1	Metal film	1150	½	½W
R2	Metal film	856	½	½W
R3	Metal film	1150	½	½W
R4	Metal film	732	½	½W
R5	Metal film	2980	½	½W
R6	Metal film	732	½	½W
R7	Metal film	634	½	½W
R8	Metal film	9530	½	½W
R9	Metal film	634	½	½W
R10	Metal film	604	½	½W
R201	Metal film	1.91k	1	½W
R202	Metal film	1.91k	1	½W
R203	Metal film	1.62k	1	½W
R204	Carbon film	680	5	½W
R205	Carbon film	3.9k	5	½W
R206	Metal film	1.5k	1	½W
R207	Metal film	4.22k	1	½W
R208	Metal film	1.5k	1	½W
R209	Carbon film	68k	5	½W
R210	Carbon film	10k	5	½W
R211	Carbon film	10k	5	½W
R212	Carbon film	68k	5	½W

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
R213	Carbon film	3.9k	5	½W
R214	Metal film	4.22k	1	½W
R215	Metal film	1.5k	1	½W
R216	Carbon film	680	5	½W
R217	Metal film	1.5k	1	½W
R218	Carbon film	10k	5	½W
R219	Carbon film	100	5	½W
R220	Carbon film	270	5	½W
R221	Metal film	4.75k	1	½W
R222	Carbon film	68k	5	½W
R223	Carbon film	560	5	½W
R224	Carbon film	560	5	½W
R225	Carbon film	68k	5	½W
R226	Carbon film	270	5	½W
R227	Carbon film	10k	5	½W
R228	Carbon film	100	5	½W
R229	Metal film	4.75k	1	½W
R230	Carbon film	9.1k	5	½W
R231	Carbon film	220	5	½W
R232	Carbon film	4.7k	5	½W
R233	Carbon film	470	5	½W
R234	Carbon film	33k	5	½W
R235	Carbon film	2.2k	5	½W
R236	Carbon film	100	5	½W
R237	Carbon film	15k	5	½W
R238	Carbon film	10k	5	½W

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
R239	Carbon film	10k	5	½W
R240	Carbon film	3.9k	5	½W
R241	Carbon film	180	5	½W
R242	Carbon film	910	5	½W
R243	Carbon film	150	5	½W
R244	Carbon film	180	5	½W
R245	Carbon film	10k	5	½W
R246	Carbon film	470	5	½W
R247	Carbon film	33k	5	½W
R248	Carbon film	15k	5	½W
R249	Carbon film	2.2k	5	½W
R250	Carbon film	100	5	½W
R251	Metal film	604	½	½W
R252	Carbon film	100	5	½W
R253	Carbon film	220	5	½W
R254	Carbon film	15k	5	½W
R255	Carbon film	3.9k	5	½W
R256	Carbon film	6.8k	5	½W
R257	Carbon film	2.7k	5	½W

6.2 Capacitors

C201	Polystyrene	950p	1	30V
C202	Polystyrene	0.01	1	30V
C203	Polystyrene	0.1	1	30V
C204	Polystyrene	950p	1	30V
C205	Polystyrene	0.01	1	30V
C206	Polystyrene	0.1	1	30V

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
C207	Polystyrene	950p	1	30V
C208	Polystyrene	0.01	1	30V
C209	Polystyrene	0.1	1	30V
C210	Polystyrene	950p	1	30V
C211	Polystyrene	0.01	1	30V
C212	Polystyrene	0.1	1	30V
C213	Electrolytic	10		25V
C214	Electrolytic	10		25V
C215	Ceramic	22p	5	200V
C216	Ceramic	22p	5	200V
C217	Electrolytic	10		25V
C218	Electrolytic	10		25V
C219	Electrolytic	47		10V
C220	Electrolytic	10		25V
C221	Electrolytic	150		16V
C222	Electrolytic	150		16V
C223	Electrolytic	47		10V
C224	Electrolytic	10		25V
C225	Electrolytic	150		16V
C226	Electrolytic	10		25V
C227	Ceramic	22p	5	200V
C228	Electrolytic	150		16V
C229	Electrolytic	150		16V
C230	Electrolytic	100		25V
C231	Ceramic	22p	5	200V
C232	Electrolytic	10		25V

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
C233	Electrolytic	150		16V
C234	P.E.P.T.	1	10	100V
C235	P.E.P.T.	1	10	100V
C236	Electrolytic	10		25V

6.3 Semiconductors

VT201	Transistor, NPN, Texas, BC183LA			
VT202	Transistor, NPN, Texas, BC183LA			
VT203	Transistor, NPN, Texas, BC183LA			
VT204	Transistor, NPN, Texas, BC183LA			
VT205	Transistor, NPN, Texas, BC183LA			
VT206	Transistor, NPN, Texas, BC183LA			
VT207	Transistor, NPN, Texas, BC183LA			
VT208	Transistor, NPN, Texas, BC183LA			
VT209	Transistor, NPN, Texas, BC183LA			
VT210	Transistor, NPN, Texas, BC183LA			
VT211	Transistor, NPN, Texas, BC183LA			
VT212	Transistor, NPN, Texas, BC183LA			
VT213	Transistor, NPN, Texas, BC183LA			
VT214	Transistor, NPN, Texas, BC183LA			
D201	Zener diode, Int. Rect. 1ZM12T5		5	12V,1W
D202	Zener diode, Int. Rect. 1ZM20T5		5	20V,1W
D203	Ger.diode, Mullard, OA91			
D204	Ger.diode, Mullard, OA91			

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
6.4	**Variable Resistors**			
RV1A-B	Wirewound, dual, ganged, Semi-log A	50k+50k	2	4W
RV2	Carbon Pot. linear	10k	20	½W
RV3	Carbon Pot. linear	10k	20	½W
RV4 A-B	Wirewound, dual ganged, Semi-log A	50k+50k	2	4W
RV201	Preset, cermet, 90H	1k	10	½W
RV202	Preset, cermet, 90H	1k	10	½W
RV203	Preset, cermet, 90H	4.7k	10	½W
RV204	Preset, cermet, 90H	470	10	½W
RV205	Preset, cermet, 90H	470	10	½W

6.5 Miscellaneous

S1A-D Output level attenuator switch, rotary, Dymar Drawing No. A3-103812

S201A-B to S203A-B Frequency range switch, 3 Module 2 pole c/o, Interdependent, SC150

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
S204A-B to S206A-B	Frequency range switch, 3 Module 2 pole c/o, Interdependent, SC150			
S207A-D to S210A-D	Function switch, 4 Module, 4 pole c/o, Interdependent, SC150			
TH201	Thermistor, I.T.T. RA54			
TH202	Thermistor, I.T.T. RA54			
SK2	BNC – Bulkhead Socket, 50Ω			
SK3	BNC – Bulkhead Socket, 50Ω			
	Meter, 100μA – Dymar Drawing No. A3-104461			

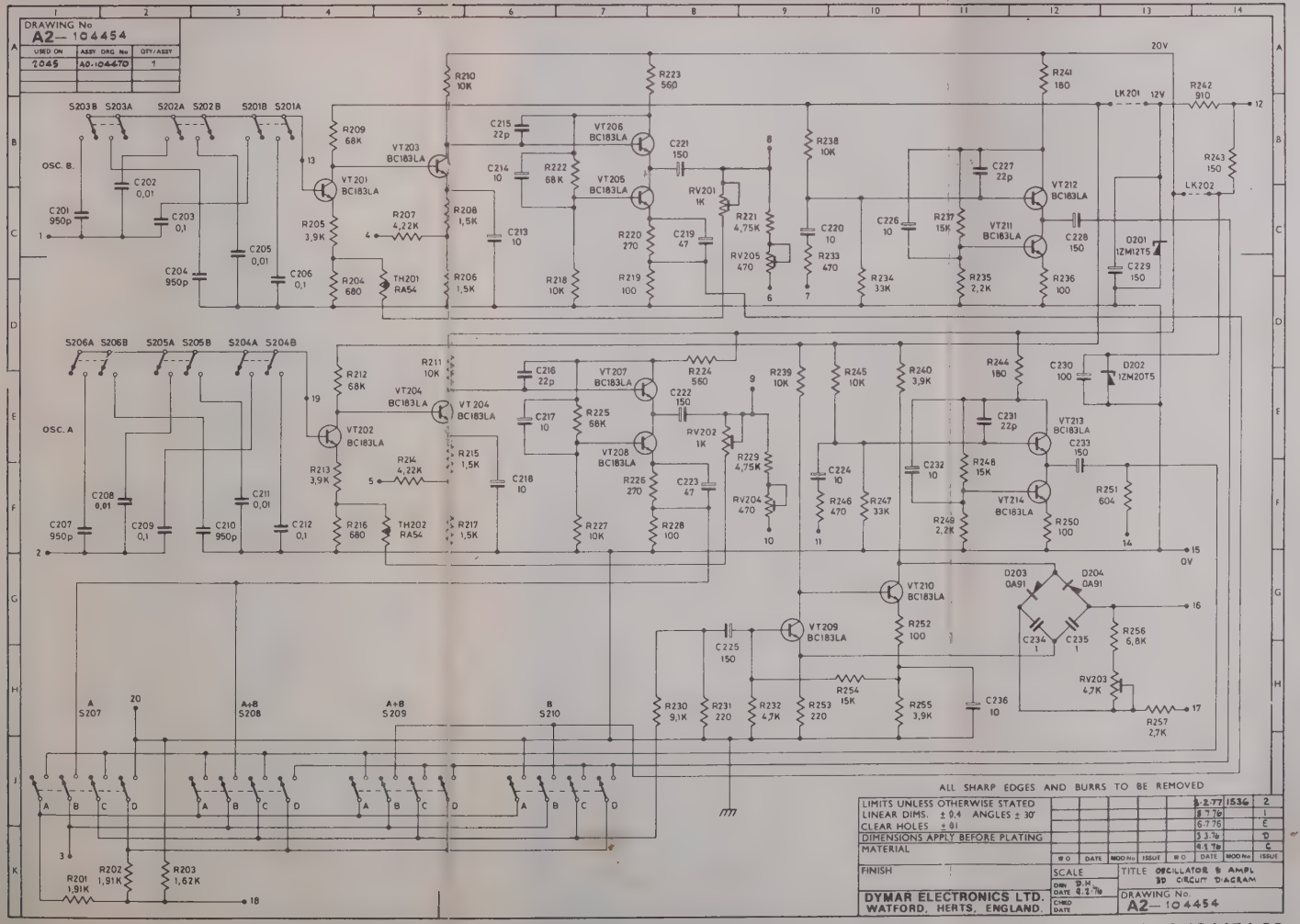
6.8 Mains Supply Components

R101	Carbon film	1k	5	½W
R102	Carbon film	15k	5	½W
R103	Carbon film	2.2k	5	½W
C101	Electrolytic	2200		63V
VT101	Transistor, NPN, R.C.A. 2N5296			
D101	Bridge Rect. In.Rect. 1SB 10A			100V 1A
D102	Zener diode, Int.Rect. 1ZM27T5		5	27V, 1W
T1	Avel Lindberg	40/2515		
F1	Fuse,			
	Delay Type 20x5mm	150mA		230V supply
	Delay Type 20x5mm	300mA		115V supply
S101	Push Button Switch 2 pole c/o Newrella	SC150		

Circuit Ref.	*Description*	*Value*	*Tol.%*	*Rating*
PL1	3 pole mains r.f. filter			6A, 250V a.c.
SK1	3 pole mains connector			

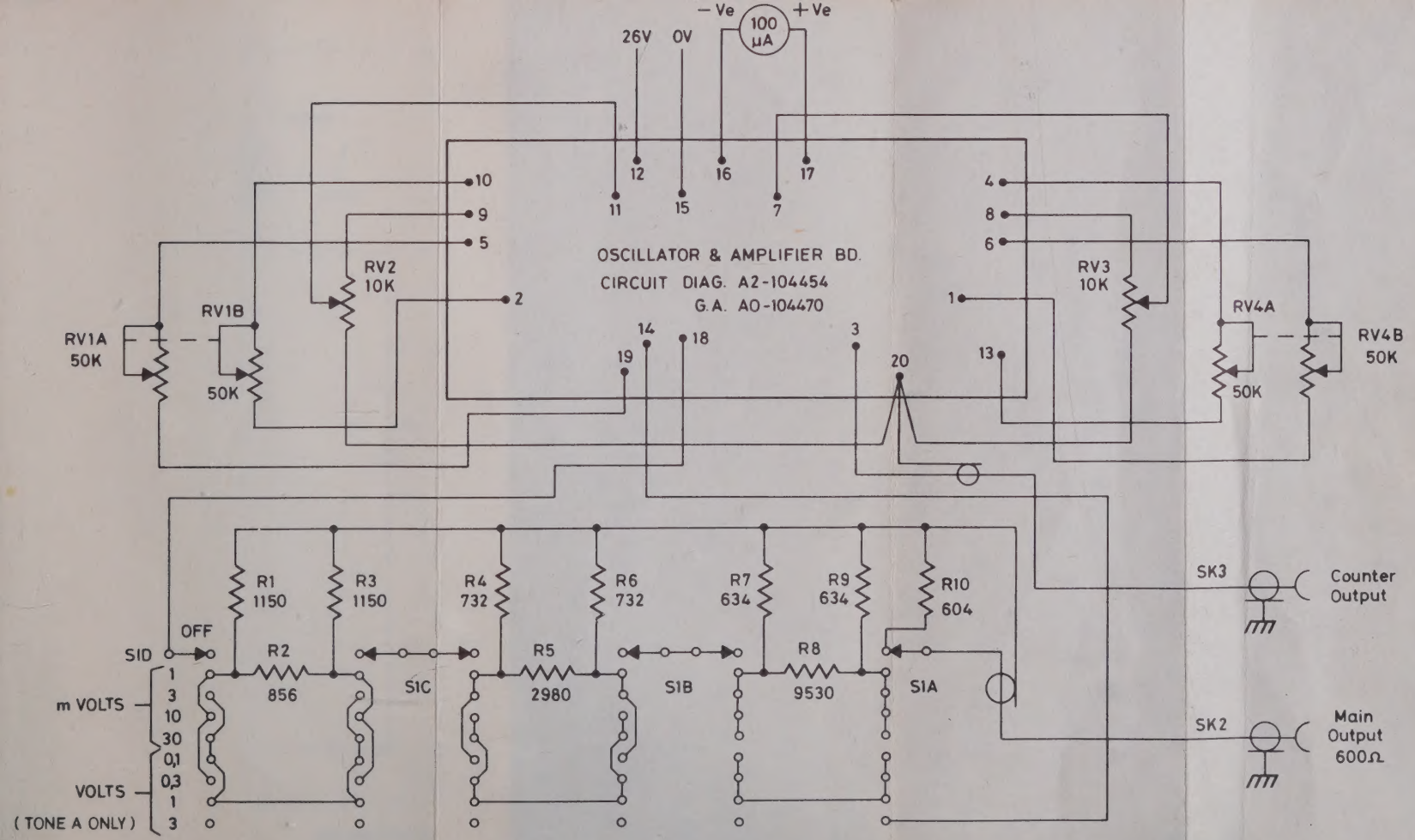
6.9 Battery Supply Components

R1001	Carbon film	6.8k	5	½W
R1002	Wirewound	680	10	5W
R1003	Carbon film	1.5k	5	½W
RV1001	Preset, cermet 90H	1k	10	½W
VT1001	Transistor, NPN, Texas, BC183LA			
D1001	Diode, I.T.T. 1N4002			100V, 1A
D1002	Zener diode, Int. Rect. 1ZM20T5		5	20V, 1W
	Battery, Nickel Cadmium 3 x 7/225DK			25V, 225mAh
S1001	Slide switch	Waycom SSP 225R		
S1002	Slide switch	Waycom SSP 225R		



Oscillators and Amplifiers

A2-104454-02



Two-Tone A.F. Signal Generator Type 2045

A3-104710-02

MP MASTER
MA235